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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
	)	ET Docket No. 96-102
Amendment of the Commission's Rules to	)	RM-8648
Provide for Unlicensed NII/SUPERNet	)	RM-8653
Operations in the 5 GHz Frequency Range	)	

COMMENTS OF JOINT COMMENTERS

Cheryl A. Tritt
Charles H. Kennedy
Morrison & Foerster LLP
2000 Pennsylvania Avenue, N.W.
Washington, D.C. 20006-1888
(202) 887-1500

Attorneys for ICO Global Communications

Nancy J. Thompson
COMSAT INTERNATIONAL
COMMUNICATIONS
6560 Rock Spring Drive
Bethesda, MD 20871
(301) 214-3473

Attorney for COMSAT CORPORATION

July 15, 1996

SUMMARY

The Commission's proposal to permit operation of unlicensed NII/SUPERNet devices in the 5 GHz frequency range will not serve the public interest unless these devices operate within technical standards that prevent interference with licensed uses. Accordingly, the Commission should defer a decision on this proceeding until the NII/SUPERNet and mobile satellite service ("MSS") industries have developed standards that will prevent interference with MSS feeder link transmissions. In the alternative, the Commission should adopt regulations that include the safeguards proposed in these Comments.

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COMSAT Corporation ("COMSAT") and ICO Global Communications ("ICO") (hereinafter jointly referred to as the "Joint Commenters") do not oppose the Commission's proposal to permit operation of unlicensed NII/SUPERNet devices in the 5 GHz frequency range, and agree that the proposed longer-range, higher-power applications in the 5150-5350 MHz range should not be permitted.[1] As the Joint Commenters explain more fully below, however, the proposed rules fail to address the risk that NII/SUPERNet devices will interfere with licensed uses, including feeder links between mobile satellite service ("MSS") satellites and earth stations. In order to prevent severe disruption of mobile satellite services, therefore, the Commission should defer a

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[1] *Amendment of the Commission's Rules to Provide for Unlicensed NII/SUPERNet Operations in the 5 GHz Frequency Range,* ET Docket No. 96-102, Notice of Proposed Rule Making, FCC No. 96-193 at ¶47, (May 6, 1996).

decision in this proceeding until representatives of the SUPERNet and MSS industries have developed technical transmission standards on which effective rules can be based. In the alternative, if the Commission chooses to adopt rules in the absence of industry standards, those rules should prohibit outdoor use of these devices or set reasonable technical limits on both their indoor and outdoor operations.

Statement of Interest

ICO plans to provide global mobile communications services via satellites in nongeostationary orbit. COMSAT expects to operate a satellite feeder link /earth station in the U.S. and act as a distributor of ICO service. The ICO system, which represents a projected investment of approximately $3 billion, will provide a variety of affordable communications services to users in the U.S. and around the world. Services will be provided through a combination of nongeostationary satellites, associated earth stations, mobile telephone units, terrestrial mobile radio systems and public switched telephone network facilities. A critical component of these services will be the feeder links connecting the satellites with the system's earth stations. Unacceptable levels of interference with these links will have a substantial, adverse impact on the Joint Commenters and their customers.

DISCUSSION

I. Under the Commission's Proposed Rules, NII SUPERNet Devices Will Interfere with Licensed Uses.

In order to receive uplink signals from their earth stations, ICO's MSS satellites will carry sensitive antennas tuned to receive transmissions from the earth's surface in the

band 5150-5250 MHz. Because the field of view of each ICO MSS satellite is large enough to take in the entire continental United States, the MSS satellite antennas will have the potential to receive transmissions, not only from their associated earth stations, but from any device located in the United States that emits electromagnetic energy in the 5150-5250 MHz frequency range.

Given these circumstances, the potential for harmful interference from NII/SUPERNet devices is substantial. All NII/SUPERNet devices will operate within the fields of view of the ICO and other global MSS satellites and will generate emissions in frequencies those satellites are tuned to receive. Because the NII/SUPERNet devices will be portable and unlicensed, their numbers and distribution within the satellites' footprints will be impossible to predict and control with complete confidence. And because the ratio of indoor to outdoor uses of the devices cannot be predicted with complete confidence, it is difficult to determine what part of the aggregate emissions they produce will be reduced by operation within buildings.

These uncertainties require that technical rules for NII/SUPERNet operation be based on conservative assumptions, and that those assumptions hold for the entire useful life of at least the first two generations of MSS satellites. The attached Appendix provides such assumptions and calculates the potential for harmful interference accordingly.

As the Appendix shows, any rules adopted in this proceeding must assume that at least 50 million NII/SUPERNet devices will be in use in North America by the year

2010.[2] This number is a reasonable projection from the present, accelerating deployment of personal computers in the United States, and corresponds closely with similar projections made by European computer and computer networking companies.

As the Appendix also explains, the level of potentially interfering emissions produced by 50 million North American NII/SUPERNet devices will depend on the ratio of indoor to outdoor use. Accordingly, the analysis in the Appendix shows the impact of NII/SUPERNet emissions for three such ratios.[3] Given the growing popularity of laptop, notebook and other portable computers, these assumptions are likely to prove conservative.

Finally, the potential for interference from any terrestrial source will vary according to the source's location within the satellite's field of view. Accordingly, the Appendix makes the simplifying assumption of an even distribution of devices within the satellite footprint, and rates the potential for interference separately for each of a series of rings radiating outward from the center of the satellite's field of view.[4]

The results of this analysis demonstrate the inadequacy of the proposed regulations to control harmful interference through the useful life of the ICO and other global MSS satellites. Depending on the extent of outdoor use, 50 million devices, fully

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[2] Appendix at 5.

[3] Appendix at 7.

[4] Appendix at 6-7.

compliant with the proposed rules, will rob MSS feeder links of power[5] and produce interference well in excess of a reasonable carrier-to-interference ratio of 24 dB.

II. Adequate Interference Protection Requires Prohibition or Limitation of Outdoor Use of NII/SUPERNet Devices.

While the Joint Commenters are willing to share the 5 GHz band with unlicensed users, the appended analysis shows that those uses--especially in outdoor applications -- must be subject to more rigorous control than the proposed rules will provide. The Joint Commenters believe that those controls can best be developed voluntarily, through discussions between the SUPERNet and MSS industries, and recommend that the Commission defer a decision in this proceeding until those discussions can be concluded. If the Commission chooses to enact rules at this time, however, the Joint Commenters recommend that outdoor use of NII/SUPERNet devices be prohibited in the 5 GHz band, or that equipment likely to be used in outdoor applications be limited to a peak EIRP density of -30 dBW/20 MHz, with a peak transmission duty cycle of 10% and a peak burst transmission time of 10 milliseconds.[6] These restrictions will have minimal impact on the usefulness of the NII/SUPERNet devices, and will preserve the viability of licensed MSS services that this Commission has recognized as serving a significant public interest.[7]

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[5] "Power robbing" is defined as the percentage of satellite transponder power captured by interference noise. See Appendix at 3.

[6] The Joint Commenters also recommend that indoor NII SUPERNet devices comply with a peak EIRP density of -10 BW/20 MHz, with a peak transmission duty cycle of 10% and a peak burst transmission time of 10 milliseconds.

[7] *See, e.g., Amendment of Section 2.106 of the Commission's Rules to Allocate the 1610-1626.5 MHz and the 2483.5-2500 MHz Bands for Use by the Mobile-Satellite*

Conclusion

Both the Commission and the MSS industry have expended considerable effort, for a number of years, to achieve adequate international spectrum allocations for user and feeder links to be used in nongeostationary satellite mobile communications systems. Those efforts will be wasted if a new, unlicensed application is allowed to share the feeder link spectrum on terms that do not protect primary licensed MSS feeder link uses from harmful interference and power robbing. The Joint Commenters strongly urge that the modest precautions suggested here be included in any regulations that result from this proceeding.

Respectfully submitted,

By: _____

Cheryl A. Tritt
Charles H. Kennedy
Morrison & Foerster LLP
2000 Pennsylvania Avenue, N.W.
Washington, D.C. 20006-1888

Attorneys for ICO Global Communications, Inc.

_____

Nancy J. Thompson
COMSAT INTERNATIONAL COMMUNICATIONS
6560 Rock Spring Drive
Bethesda, MD 20871
(301) 214-3473

Attorney for COMSAT CORPORATION

July 15, 1996

Service Including Non-Geostationary Satellites, 9 FCC Rcd 536, 539 (1994) *modified*, 10 FCC Rcd 3169 (1995).

APPENDIX TO COMMENTS OF JOINT COMMENTERS

I. TECHNICAL INTERFERENCE ANALYSIS

The Joint Commenters believe that the Commission should not adopt detailed rules governing operation of NII/SUPERNet devices in the 5GHz band until information is available on which compatibility studies can be based. Unlike the case of HIPERLAN, for which European Technical Standards Institute ("ETSI") standards are in place, there are no specific technical transmission standards for the propsed SUPERNet devices. It is therefore extremely difficult to undertake a rigorous or representative analysis of the interference levels caused by SUPERNet to MSS satellites. There also appears to be insufficient information available to make an accurate estimate of the expected population of SUPERNet type devices expected to be deployed in the US (and elsewhere) over a 10-20 year timeframe.

In order to remedy these deficiencies, the Commission should ensure that representatives of the SUPERNet and MSS communities exchange detailed and valid information on their respective systems which would then enable a more complete analysis to be conducted. The Joint Commenters therefore recommend that the Commission defer taking a decision on this matter until the SUPERNet and MSS industries have a reasonable opportunity to conclude discussions concerning interference problems.

If the Commission nonetheless chooses to develop regulations at this time, those regulations should be based on conservative assumptions and should ensure compatible operation of MSS feeder links and NII SUPERNetdevices through at least the useful life of the first two generations of MSS satellites. The following analysis, which is based on

the Commission's proposed standards and on conservative, realistic assumptions where hard information is not available, is offered as the basis for any rules adopted in this proceeding.

1 General MSS Characteristics

Nongeostationary orbit ("NGSO") MSS satellite systems such as Globalstar, ICO, Constellation and others plan to use the 5092-5250 MHz band for earth-to-space feeder links (feeder uplinks) pursuant to the decisions of the recent ITU WRC-95. The band 5092-5250 MHz is internationally allocated to the Fixed Satellite Service (Earth-to-space) on a worldwide basis for use by non-geostationary MSS feeder links. The feeder uplinks are used to provide communications from the public networks to the end-user, who may be equipped, for example, with personal satellite phones operating in the relevant MSS service-link bands below 3 GHz.

The MSS feeder uplinks will be served by a relatively limited number of earth stations transmitting MSS signals to MSS satellites. ICO, for example, plans to implement no more than 12 feeder link stations, or so-called satellite access nodes ("SANs"), worldwide. Similarly, all of the proposed MSS sytems operating in the 5 GHz uplink band will operate no more than 30 feeder link earth stations in the United States.

The MSS satellites, which are currently planned to operate with a receive band within the 5092-5250 MHz range, all use earth coverage antennas -- that is, the coverage area is the full field of view the satellite. Such MSS satellites are subject to interference from the aggregate effect of all visible terrestrial emitters, such as the proposed NII/SUPERNet devices, Aeronautical Radionavigation Service systems such as government and civilian

MLS systems operated in the US and elsewhere, and out-of-band emissions from high power military Radiolocation radars operating above 5250 MHz.

MSS operators need to be assured:

i. That aggregate interference from other sources (such as SUPERNet) does not give rise to unacceptable co-channel interference on MSS feeder link communications channels. Interference typically is expressed in terms of meeting a specified Carrier-to-Interference (C/I) ratio. Interference causing a lower C/I than the specified value is unacceptable and harmful.

ii. That aggregate interference from other sources (such as SUPERNet) does not give rise to robbing of the available satellite power, which has been optimized to maximize wanted communications throughput. Any significant "power robbing"[12] would substantively reduce the capacity of the MSS system to offer commercial communications services.

2 Typical ICO System Parameters

The ICO MSS satellite system will comprise a constellation of 10 operational satellites, describing circular orbits at an altitude of 10,355 km.

The ICO receive (at 5 GHz) and transmit (at 7 GHz) feeder link antennas are full coverage antennas and see a field of view comprising more than 25% of the earth's total surface area. The reference ITU-R parameters for the so-called LEO-F satellite system, which are broadly representative of the ICO satellite system, are used for the purposes of

[1] "Power robbing" is defined as the percentage of satellite transponder power captured by interference noise

this interference assessment The 5 GHz feeder link receive satellite antenna gain is circa 15 dBi at sub-satellite point with an edge-of-coverage gain of circa 12 dBi.

The ICO MSS carriers use a 6 slot TDMA carrier with a 36 kbit/s burst rate using a QPSK modulation scheme with a TDMA channel allocated bandwidth of 25 kHz. The typical uplink EIRP / TDMA carrier is circa 46 dBW.

It is normal practice in the satellite industry to attribute 6% of the total noise to one source of co-primary external interference -- *i.e.*, a delta-T/T of 6%. In the case of interference from unlicensed devices operating within the primary MSS feederuplink frequency allocations, ICO considers that a delta-T/T of 1.0% is appropriate. *Therefore, the target C/I criterion for interference caused to ICO feeder links by SUPERNet devices is 24 dB. A reasonable threshold of the order of 0.5% of the satellite power should not be lost due to power robbing from a single class of interfering sources such as a population of SUPERNET devices.*

3 Assumed SUPERNet Characteristics

a) Number of SUPERNet Devices

The advocates of the NII/SUPERNet devices anticipate that there will be mass market usage of these unlicensed devices. In Europe alone over a 15-20 year timeframe there could be 100 million or more HIPERLAN type devices (similar to SUPERNet devices). At first sight such numbers may seem rather large. However, in a 20-year timeframe, for example by the year 2015, one can reasonably expect that the personal, industrial-plant and business computers will generally be equipped with 5 GHz SUPERNet/HIPERLAN

capability and that there could well be other applications for in-building data transmission use which would essentially use the same or similar radio-based technology.

It would be imprudent to exclude the possiblity, therefore, that over such a timeframe, first or second generation MSS satellite systems will be subject to interference by an uncontrollably large number of SUPERNet/HIPERLAN devices in use in various countries of Europe and North America, and probably in ALL countries of the world. The number of potential interferers could reasonably exceed 100 million in North America by or before the year 2015. The key point is that there is no regulatory mechanism which can formally limit the number of such unlicensed device usage. MSS operators must therefore assume a reasonable worst case situation over the expected lifetime of first and subsequent generations of MSS satellites expected to provide service at least until the year 2020.

For the purposes of the interference assessment below, it is conservatively assumed that in the US alone, by the year 2010, approximately 50 million SUPERNet devices will be deployed in the 5 GHz range.

b) Indoor / Outdoor Use Ratios & Signal Blockage

Another key issue which will impact the levels of interference from such unlicensed devices to satellite receivers is the question of what proportion of such use will be deep in building, in-buildings and outdoors. For a given unlicensed device type, fulfilling certain technical emission standards, the higher the number of outdoor devices in use, the higher the level of interference to MSS satellite receivers. It is assumed in the analysis that

0.0001%, 0.1% and 1% of a total population of 50 million SUPERNet type devices in the US are used outdoors.

It is also necessary to make assumptions on the level of blockage or attenuation which would be experienced due to building walls and roofs. Indoor SUPERNet emissions would be attenuated by building blockage. Such attenuation could be anywhere in the region 2-3 dB (for windows) to typically 10-20 dB depending on how deep inside a building the device is located. . It is provisionally assumed in the analysis that "average" blockage of 10 dB would be applicable for indoor SUPERNet uses.

c) Transmission Parameters

It is assumed that the SUPERNet devices each comply with the Commission's proposed peak EIRP of -10 dBW.

It is further assumed that the transmissions from each device would comply with a peak duty cycle of 10% (*i.e.,* transmissions occurring for a maximum of 1/10 of the time), noting that the Commission has *not* proposed to specify a particular duty cycle, but only that burst transmissions should not exceed 10 milliseconds in duration.

The channel bandwidth of the transmissions is typically assumed to be 20 MHz, noting that the Commission has currently declined to specify a particular standard for transmission bandwidths. The 20 MHz channel bandwidth assumption is reasonably consistent with that for the HIPERLAN system.

4 Method of Analysis

The method of analyses used is as follows.

The impact of all SUPERNet devices on MSS satellites is based on the simplifying assumption that devices are uniformly distributed over the earth's surface within the applicable field of view of the MSS satellite. The average SUPERNet density is based on the assumed population of 50 million such devices in use in the US by the year 2010. It is assumed that all SUPERNet devices are operated over a 200 MHz range between 5150 MHz and 5350 MHz, as per the Commission's proposals. It also is estimated that in any given 20 MHz slot, the number of operational SUPERNet devices is given by the total population of SUPERNet devices multiplied by the ratio 20/200. If SUPERNet devices are not ultimately authorised in, for example, the 5250-5350 MHz range, this density of SUPERNet devices in the 5150-5250 MHz range would increase.

The field of view of the given NGSO MSS satellite is divided into number of annular strips or rings on the earth's surface. For each ring, the impact of interference from all SUPERNet emitters located in that ring is estimated by taking into account the SUPERNet device carrier parameters, the range loss to the MSS satellite and the MSS satellite receive antenna gain in that direction. This process is then repeated for all such rings to provide an estimate of the total aggregate interference power in a 20 MHz slot. The interference power in each MSS channel is obtained by the ratio of MSS channel bandwidth (25 kHz for ICO) to assumed SUPERNet channel bandwidth of 20 MHz.

5 Typical Results of Interference Analysis

Table 1 estimates the impact of the levels of interference that would be caused by 50 million SUPERNet devices, assuming three different ratios of indoor to outdoor use.

TABLE 1: IMPACT OF SUPERNET ON MSS FEEDER LINKS

Assumed % Of Outdoor/Indoor Use	C/I (dB)	Power Robbing (%)
0.0001	23.6	4.5
0.1	23.5	4.7
1.0	23.2	5.0

As Table 1 shows, the C/I criterion of 24 dB for the ICO satellite system is not respected - even if the outdoor population of unlicensed devices is assumed to be limited to 0.0001 % of the total.

It can also be seen that there is significant satellite power robbing, well in excess of the acceptable 0.5% threshold. - even if the outdoor population of unlicensed devices is assumed to be limited to 0.0001 % of the total.

A higher number of outdoor SUPERNet devices -- *e.g.*, 1% of the total assumed population -- would worsen the co-channel C/I and increase the level of satellite power robbing.

II. CONCLUSIONS AND PROPOSALS

Based on the technical analysis described in Section III above, the Joint Commenters conclude that there would be unacceptably high and harmful levels of interference caused by SUPERNet devices to MSS satellite systems if :

- there is an eventually large population of SUPERNet devices deployed outdoors;
- the transmission parameters of the SUPERNet devices are not constrained in terms of maximum peak EIRP, peak EIRP/density, maximum transmission duty cycle etc.

Depending on the assumptions used, it can also be shown that indoor only use of SUPERNet devices can cause unacceptable or harmful interference to MSS satellites.

The Joint Commenters recognize that the Commission cannot readily restrict the unlicensed use of outdoor SUPERNet users to a fixed number of devices or a certain percentage of the total device population. The only practicable method would be to impose constraints on the transmission parameters of the indoor and outdoor SUPERNet devices, which would effectively limit the potential for harmful interference by a large population of out-door or near out-door SUPERNet use.

The Joint Commenters recommend further industry discussions to assess the SUPERNet/MSS compatibility issues, taking into account specific technical information on the likely transmission standards for SUPERNet devices as well as specific MSS technical characteristics.

The Joint Commenters therefore recommend that the Commission propose, as a basis for the above industry discussion, the following provisional technical standards for SUPERNet devices.

- Indoor SUPERNet devices comply with a peak EIRP density of -10 dBW/20 MHz with a peak transmission duty cycle of 10% with a peak burst transmission time of 10 milliseconds.
- Outdoor SUPERNet devices comply with a peak EIRP density of -30 dBW/20 MHz with peak transmission duty cycle of 10% with a peak burst transmission time of 10 milliseconds.

The Joint Commenters' proposals for indoor SUPERNet devices are consistent with those proposed by the Commission, with the added requirement of a peak duty cycle. The Joint Commenters' proposals for outdoor SUPERNet devices is broadly consistent with

the existing Part 15 intentional radiators EIRP levels permitted in the upper 5 GHz range. *See* 47 CFR Sec. 15.249.

The Joint Commenters recommend that, if the Commission wishes to proceed with immediate action in this proceeding without awaiting the results of the further industry consultation, then the Commission should :

- adopt the above proposed technical standards for indoor SUPERNet devices (*i.e.*, a peak EIRP density of -10 dBW/20 MHz with a peak transmission duty cycle of 10% and a peak burst transmission time of 10 milliseconds);
- prohibit any outdoor use of SUPERNet devices, or adopt the standards for outdoor devices proposed herein as regulations.

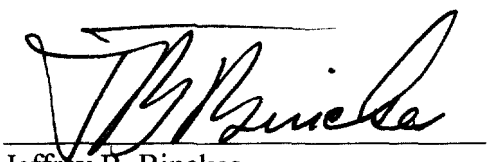
The Joint Commenters fully concur with the Commission's view that the higher power, longer range unlicensed devices proposed by some petitioners, including Apple, for external use should not be authorised in the 5150-5250 MHz bands. Any such use within the 5100-5250 MHz range would catastrophically impact the viability of MSS satellite services already in advanced stages of implementation.

Finally, the Joint Commenters concur with the Commission's view that unlicensed SUPERNet devices continue to be regulated by the current Part 15 rules, together with the technical standards the Joint Commenters have proposed.

DECLARATION OF TECHNICAL ACCURACY

I hereby certify that I am the technically qualified person responsible for the preparation of the engineering information contained in the foregoing Appendix to Comments of Joint Commenters, that I am familiar with Part 25 of the Commission's Rules as well as with the technical characteristics of the radiocommunications systems described in the Appendix, that I have either prepared or reviewed the engineering information submitted in the Appendix, and that it is complete and accurate to the best of my knowledge and belief.

Date: July 15, 1996



Jeffrey B. Binckes
Director, Spectrum Utilization
& ITU Standards
COMSAT INTERNATIONAL
COMMUNICATIONS

CERTIFICATE OF SERVICE

I, Kathryn M. Stasko, do hereby certify that the foregoing **COMMENTS OF ICO GLOBAL COMMUNICATIONS** has been furnished, via hand delivery on this 15th day of July, 1996, to the following:

William F. Caton
Office of the Secretary
Federal Communications Commission
1919 M Street, N.W., Room 222
Washington, D.C. 20554

Chairman Reed E. Hundt
Federal Communications Commission
1919 M Street, N.W., Room 814
Washington, D.C. 20554

Commissioner James H. Quello
Federal Communications Commission
1919 M Street, N.W., Room 802
Washington, D. C. 20554

Commissioner Rachelle B. Chong
Federal Communications Commission
1919 M Street, N.W., Room 844
Washington, D.C. 20554

Commissioner Susan Ness
Federal Communications Commission
1919 M Street, N.W., Room 832
Washington, D.C. 20554

Don Gips
Chief
International Bureau
Federal Communications Commission
2000 M Street, N.W., Room 800
Washington, D.C. 20554

Thomas Tycz
Chief
Satellite & Radiocommunications Division
International Bureau
Federal Communications Commission
2000 M Street, N.W., Room 800
Washington, D.C. 20554

Cecily C. Holiday
Deputy Chief
Satellite & Radiocommunications Division
International Bureau
Federal Communications Commission
2000 M Street, N.W., Room 800
Washington, D.C. 20554

Richard M. Smith
Chief
Office of Engineering & Technology
Federal Communications Commission
2000 M Street, N.W., Room 480
Washington, D.C. 20554

Bruce A. Franca
Deputy Chief
Office of Engineering & Technology
Federal Communications Commission
2000 M Street, N.W., Room 480
Washington, D.C. 20554

Michael J. Marcus
Associate Chief for Technology
Office of Engineering & Technology
Federal Communications Commission
2000 M Street, N.W., Room 480
Washington, D.C. 20554

Michele C. Farquhar
Chief
Wireless Telecommunications Bureau
Federal Communications Commission
2025 M Street, N.W., Room 5002
Washington, D.C. 20554

Kathryn M. Stasko
Kathryn M. Stasko